Going with the flow: Computer tool tracks water’s changing impact in the warming Arctic

August 16, 2020

Going with the flow: Computer tool tracks water’s changing impact in the warming Arctic

by David Moulton

Almost a quarter of the ground in the Northern Hemisphere is permafrost. This frozen ground supports critical energy infrastructure and unique ecosystems, and it also serves as one of the largest land-based stores of organic carbon matter on Earth. Across the world, permafrost traps 1,300 billion tons of carbon, or twice as much carbon as what’s in our atmosphere.

Permafrost is thawing as global temperatures rise, driving rapid change and unanticipated dangers in and beyond the Arctic. Immediate impacts include the recent collapse of the Norilsk oil storage facility, which caused a massive oil spill into the Ambarnaya River near the Arctic ocean in Russia. Less obvious, but with global impact, is the growing amount of carbon dioxide and methane released through the thawing and decomposition of this huge permafrost carbon store.

These increasing emissions can serve to increase the heat trapped by the greenhouse effect, which in turn can lead to more thawing. While not fully understood, this feedback loop is one of the more well-known and worrying potential climate change outcomes. Current models that do not yet include the permafrost-thaw feedback indicate that for each degree Celsius that the global temperature rises, one million square miles of permafrost will thaw. Adding in the extra emissions from permafrost thaw could mean the geographic extent of thaw per degree Celsius may be much worse. Recent research into phenomena like abrupt permafrost thaw suggests that our estimates for CO2 released from thawing permafrost may need to increase by as much as 50 percent.

Understanding how water moves through the permafrost landscape is vital to understanding permafrost-carbon-climate feedbacks. Water carries nutrients; it carries energy. It can increase not only the rate of permafrost thaw, but the carbon dioxide and methane output, too. To understand the impact of these hydrologic feedbacks, Los Alamos National Laboratory, with collaborators from Oak Ridge National Laboratory in Tennessee, led the development of a new open-source simulation tool called Amanzi-ATS.

This story first appeared in **Santa Fe New Mexican**.